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Text:
Record of Decision

The Decision Summary

Madison County Landfill Site

Madison, Madison County, Florida

Prepared By:
U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia

RECORD OF DECISION

DECLARATION

SITE NAME AND LOCATION

Madison County Landfill Site
Madison, Madison County, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action at the Madison County Landfill Site in Madison, Madison County, Florida, which was chosen in accordance with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for this site.

The State of Florida, as represented by the Department of Environmental Regulation (FDER), has been the support agency during the Remedial Investigation and Feasibility Study process for the Madison County Landfill Site. In accordance with 40 C.F.R. S 300.430, FDER, as the support agency, has provided input during this process. Based upon comments received from FDER, it is expected that concurrence will be forthcoming; however, a formal letter of concurrence has not yet been received.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This is the first and final cleanup action planned for the Site. This action addresses the source of the soil and groundwater contamination by containing the solid wastes and treating the contaminated groundwater to acceptable levels.

The major components of the selected remedy include:

- the implementation of institutional controls by state and local government agencies, which would include deedrestrictions, land use ordinances, physical barriers, and water supply well permitting prohibitions (some administrative difficulties may be encountered during implementation of these various controls);

- the construction of a groundwater extraction, treatment (air stripping and Granular Activated Carbon - GAC), and discharge (reinjection) system in the vicinity of the Yard Trash Area (YTA), located at the southeast corner of the landfill;

- the installation of a clay/soil cap over the YTA only;

- the contingent installation of a passive gas collection and control system;

- the construction of a stormwater management system;

- the implementation of an extensive groundwater monitoring program, which includes the installation of two additional monitoring well clusters; and

- long-term management controls including operation and maintenance of the groundwater treatment system and the Yard Trash Area cap.

The total present worth cost for the selected remedy as presented in the Feasibility Study is $5,191,000. The actual cost will be greater than this due to the installation of two additional monitoring well clusters and other provisions added to the selected remedy. Also, should additional sampling and groundwater monitoring during remedial design and cleanup identify other sources of groundwater contamination outside the YTA, the selected remedial action will be modified to address these areas and the costs adjusted accordingly.

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, is cost effective, and it complies with Federal and State requirements thatare legally applicable or relevant and appropriate to the remedial action. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous source materials remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

September 28, 1992
Date

Greer C. Tidwell
Regional Administrator

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Summary of Remedial Alternatives Selection

Madison County Landfill Site

Madison, Madison County, Florida

1.0 Site Name, Location, and Description

The Madison County Landfill Site (the Site) is located in Madison County, Florida, in the eastern portion of the Florida Panhandle (See Figure 1.1).

The City of Madison is the county seat, centrally located within the county. The Site is approximately two miles north-northeast of the City of Madison on county road C-591. The landfill property occupies approximately 90 acres of the National Priorities List (NPL)-listed Superfund site, which is comprised of a total 133 acres owned by the county. Also located on the NPLlisted Superfund site directly south of the landfill is the County Department of Transportation (DOT) and the County's aviation hangar and landing strip (See Figure 1.2).

The landfill was operated as an unlined trench and fill operation. Trenches (cells) of varying lengths and widths, typically 50 feet by 30 feet and approximately 15 to 25 feet in depth, were used. Municipal/domestic and industrial wastes from the area were placed in the trenches and covered with the excavated material. Reportedly, there was no master plan directing waste placement or trench orientation. Currently, approximately 40 tons of waste per day are disposed into the one group of remaining active waste cells at the Site. However, Madison County is currently proceeding to perform a closure of the active portion of the landfill in response to an order issued to the county by the Florida Department of Environmental Regulation (FDER). The closure includes the portion of the landfill actively used for waste disposal after 1985 and will consist of the construction of an earthen/clay cap. This closure is expected to begin in 1993.

Figure 1.2 depicts areas of both active and non-active (or closed) trash cell locations. The Yard Trash Area (YTA), located in the southeastern portion of the landfill, was primarily used to dispose of large bulk debris usually associated with construction and demolition activities as well as drums containing industrial wastes. The alleged Acid Disposal Area located in the southern portion of the property was reportedly used for disposal of acid wash water.

The surface of the landfill is covered with native soil that was originally excavated from the trenches in preparing cells to receive waste. Vegetative cover is absent over most of the inactive or recently closed waste cells; however, over older,

closed cells vegetative cover is present and consists of shrubs, grasses, and pine trees.

The City of Madison is supplied with potable drinking water from four water wells located at three locations within the city (See Figure 1.3), approximately 2.5 miles southwest of the Madison County Landfill. The wells range from 8 inches to 14 inches diameter, and are completed within the Floridan aquifer from 110 to 450 feet below the surface. The wells produce a total of 1.1 to 1.2 million gallons per day.

Due to relatively large hydraulic conductivities and transmissivities in the Floridan aquifer, the city wells are believed to induce a relatively small cone of depression in the potentiometric surface of the aquifer. The average drawdown in the four water wells is only 5 to 10 feet. Based on this information, the four water wells are believed not to be influencing or extracting groundwater from the vicinity of the Madison County Landfill.

The City of Madison's water system supplies water to all customers located within the direct vicinity of the city. Additionally, the city supplies water to selected residences located near the landfill. The Locust Grove subdivision located directly south of the landfill, all the residences on Route 4 located directly west of the landfill, and the residences on SR-145 from the intersection of Route-4 to C-254 are all supplied with city water.

The population of Madison County is approximately 16,000, and the population of the City of Madison is 3,700. Major industries in the County include farming and timber (pulpwood). The area surrounding the landfill is used as rural residential and agricultural. Approximately 35 individual single family residences are located within a 0.5 mile radius of the landfill property. Agricultural use in the area is quite varied. The primary agricultural use is for tree farms and field crops. The field crops consist of tobacco, soy beans, wheat, and corn. Some of the other varied uses in the area include a vineyard, livestock, water fowl, and vegetable gardens. Livestock include cattle, hogs, turkeys and chickens as well as water fowl such as ducks and geese. Other animals raised in the area include hunting dogs. 2.0 Site History and Enforcement Activities

The Madison County Landfill began operation in 1970 as a sanitary landfill operated by the City of Madison. From 1971 to March 1980, domestic waste from the City and surrounding area and local industrial wastes were disposed of in the landfill. During that time period, one local industry identified as having disposed of waste in the landfill was ITT Thompson Industries, formerly a division of ITT Corporation. Information compiled by the U.S. Environmental Protection Agency (EPA) suggests that ITT Thompson

delivered an undetermined quantity of liquid waste solvents, semisolid waste buffing compounds, and acid wash water to the landfill for disposal.

According to landfill operation personnel, 55-gallon drums containing some quantity of liquid waste solvents were disposed in a separate trash cell located in the YTA (See Figure 1.2). Two drum removal operations were conducted by EPA in November 1984 and March 1985 in which approximately 20 drums, per removal period, were recovered from the YTA. All drums in the YTA containing volatile organic compounds such as DCE/TCE were reportedly removed.

There is also information that ITT Thompson disposed of 55-gallon drums filled with waste polishing/buffer compounds at the Site. The polishing/buffer compounds are a semi-solid material used to polish automobile ornaments. Based upon interviews with landfill employees the exact location and number of drums in the landfill could not be determined because disposal was sporadic over the nine-year period. Landfill personnel stated that the drums containing buffing compounds were emptied into the trash cells with the domestic waste. The drums were then crushed and placed into the trash cells.

From 1971 to 1974, ITT Thompson arranged for the disposal of acid wash water, which reportedly was taken to the landfill. The acid wash watermay have contained chromic acid with maximum concentrations of chromium of 50 parts per billion (ppb). No information on the Ph of the acid wash water or the quantity disposed was available. According to landfill personnel, the contractor disposed of the acid wash water on the ground in the area noted as the Acid Disposal Area (Figure 1.2). Conversations with landfill personnel indicate that no other wastes were disposed in that area.

The Suwannee River Water Management District (SRWMD) designed and installed a groundwater monitoring network at the landfill in 1984. The results of the sampling events indicated the presence of several volatile organic compounds in the groundwater at and in close proximity to the landfill. This prompted FDER to take protective action, and in 1986, the Florida Department of Environmental Regulation (FDER) entered into a Consent Order with the City, County, and ITT Thompson (the three identified potentially responsible parties or PRPs) requiring them to investigate groundwater near the Site. The PRPs identified the affected private wells and provided those homes with bottled water and ice, eventually connecting each home to City water lines.

In early 1987, EPA scored the Site using the Hazard Ranking System (HRS), a numerical system for evaluating a site's potential risk to human health and the environment. The aggregate HRS score derived for the Site was 37.93 based on the level of groundwater contamination and was proposed for the National Priorities List (NPL). The Site was formally added to the NPL on June 24, 1988. On June 11, 1990 EPA entered into a Consent Order with the PRPs requiring the performance of a Remedial Investigation/Feasibility Study (RI/FS). Implementation of field activities as described in the RI/FS Work Plan began on December 10, 1990 under EPA supervision.

During the RI/FS field work activities, soil, sediment, and surface water samples were collected and 27 groundwater monitoring wells were installed and sampled. Based on the results of the initial phase of RI/FS field work, EPA recommended additional field work to further assess the extent of soil and groundwater contamination at the landfill. The additional field work focused on the YTA and the installation of an additional monitoring well, along with the collection of a second round of groundwater samples. The final phase of RI/FS field work was completed in late 1991, and the resulting RI and FS Reports were submitted and approved by EPA in April and July 1992, respectively. EPA released the Proposed Plan describing the preferred remedial alternative to the public on August 24, 1992, commencing the 30-day comment period. Comments received from the public and the State have been incorporated into the Responsiveness Summary, which is found in Appendix A of this document.

3.0 Highlights of Community Participation

In accordance with CERCLA sections 113 (k)(2)(B)(i-v) and 117 requirements, a Community Relations Plan (CRP) for the Madison County Landfill Site was developed. This Community Relations Plan outlines citizen involvement and the community's concern.

Community concern regarding the Site peaked from 1984 to 1986, when groundwater contamination was first detected in landfill monitoring wells and residential wells. Concerned community members included those having contaminated groundwater as a result of landfill operations. These affected individuals have voiced their concerns at several County Commission meetings. Citizens from Madison and surrounding communities have formed two concerned citizen groups: the North Florida Drinking Water Association and Save Our Counties (SOC).

During this 2-year period of peaked interest, a number of newspaper articles regarding the Site were published in local papers. However, minimal community involvement has occurred with regard to the Site since 1986. Currently, those concerned about the Site are residents who must pay for City water since their contaminated private wells are now nonpotable. Residents not directly affected by the Site have expressed minimal concern regarding the Site.

EPA conducted an RI/FS kick-off meeting in Madison, Florida on November 27, 1990 to inform the public of scheduled RI/FS activities and of EPA's general involvement with the Site.

Response from the community was very positive, most welcomed the help of EPA with this matter. Additionally, in April 1992 upon receipt of the field sampling results, EPA released an RI Fact Sheet describing the nature and extent of contamination at the Site.

The RI/FS Reports and Proposed Plan along with all other siterelated documents were made available to the public on August 24, 1992 in the information repository located in the North Florida Junior College Library and at the EPA Records Center in Region IV.

The public was provided an opportunity to comment on the remedial alternatives for site remediation from August 24, 1992 to September 23, 1992. In addition, a public meeting was held on September 1, 1992 in Madison, Florida to present to the community EPA's preferred alternative for source and groundwater remediation at the Site. During the public meeting, the community was informed of the availability of a Technical Assistant Grant (TAG). A response to the comments received during the public comment period is included in the Responsiveness Summary, which can be found in Appendix A of this Record of Decision.

This decision document presents the selected remedial action for the Madison County Landfill Site, in Madison, Madison County, Florida, chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan (NCP). The decision for this Site is based on the administrative record.

4.0 Scope and Role of Response Action

This is the first and final planned remedial action for this Site. The objectives for the remedy are to prevent the near-term and future exposure of human receptors to contaminated groundwater both on and off-site, to minimize the migration of contamination from the landfill to the surrounding community, to restore the groundwater to drinking water quality for the chemicals of concern, and to monitor groundwater in a manner that will verify the effectiveness of the selected remedy.

This ROD has been prepared to summarize the remedial alternative selection process and to present the selected remedial alternative for site remediation.

5.0 Summary of Site Characteristics

5.1 Geology

This section describes site geological settings including the stratigraphy, structure and lineaments.

5.1.1 Site Stratigraphy, Structure and Lineaments

The geology of Madison County involves differentiated formations from the Tertiary to the present. The lowest geologic unit of concern at this site is the white, fossiliferous Suwannee Limestone Formation of the Oligocene Series (See Figure 5.1). The lithologic description of sediment samples was recorded during the installation of 15 soil borings and 28 monitoring wells around the Madison County Landfill (Soil boring and monitoring well locations are depicted in Figures 5.2 and 5.3). The Suwannee Limestone was not encountered in two deep soil borings (SB12 and SB3, see Figure 5.2). A series of sands, silts, and clays were encountered in place of the limestone in those two soil borings.

The relatively thin and discontinuous St. Marks Formation of limestone forms the upper portion of the Floridan aquifer in Madison County. Its thickness could not be determined at the Site because samples could not be collected, due to a loss of circulation of drilling fluids in this geologic unit.

The Miocene Hawthorn Group overlies the St. Marks and Suwannee Limestone, forming the confining unit of the Floridan aquifer in this area. The Hawthorn is extremely complicated and heterogeneous, only the Torreya Formation of the Hawthorn Group is present in Madison County.

In the study area, the Hawthorn Group is composed of two lithologic units: (1) alternating layers of pure sands, clays, and lenses of silty sandy limestone ranging in thickness from 5 to 50 feet, and (2) a bluish to greenish grey, highly plastic, fat clay, which contains very little sand or silt, and has high plasticity with a liquid limit greater than 50. The fat clay unit was found in all subsurface borings except SB13 (See Figure 5.2). It ranges in thickness from 6 feet in SB5 to 60 feet in SB8. The fat clay tends to conform to the topography of the underlying Suwannee Limestone, making an effective seal, in most places, against downward movement of contaminants into the Floridan aquifer.

Sinkhole and other solution features have been formed throughout the region during the geologic past, although the limestone depression feature underlying the landfill may be due to recent dissolution activities. A total of five geologic cross sections were constructed across the landfill and the surrounding area to help illustrate the geologic relationship between the overlying sediments, the underlying Hawthorn Group, and the Suwannee Limestone. The geological cross sections are based upon lithologic well logs. In order to simplify the overall geology under the landfill, relatively minor lithologic units generally less than five feet in thickness were not incorporated into cross sections.

One east-west and two north-south cross sections were constructed across the landfill (Figures 5.4, 5.5, and 5.6). Figure 5.7 illustrates that the fat clay unit can be correlated across the entire landfill and the fat clay unit increases in thickness in the center to the western portion of the landfill. The Suwannee Limestone, however, was not detected as underlying either the western (SB12) or eastern (SB3) portion of the landfill. Limestone was encountered in the central portion of the landfill at a depth of 190 feet. Approximately 300 feet west of soil boring SB12, at soil boring SB15, limestone was encountered at the depth of 85 feet below land surface.

The cross section in Figure 5.5 parallels the western perimeter of the landfill. This cross section illustrates that the fat clay unit was not detected in soil boring SB13. The primary lithologic type in SB13 was a silty, sandy clay. Figure 5.4 also illustrates the undulatory nature of the Suwannee Limestone under the landfill.

Figure 5.6 parallels the eastern perimeter of the landfill. The fat clay unit was found to be present across this portion of the landfill property. The fat clay unit thins in the vicinity of IT1/SB1. Limestone was encountered relatively close to the surface at approximately 40 feet Mean Sea Level (MSL) at soil borings SB4 and SB1. All three cross sections illustrate that below a portion of the landfill the Suwannee Limestone was not encountered to a depth of 200 feet below the surface. In areas in which limestone was relatively deep or not found, the overlying distinguishable units were continuous.

Two cross sections were also constructed from lithologic data obtained during well installations in the vicinity surrounding the landfill. One cross section was constructed in a northwest-southeast (Figure 5.8) and another northeast-southwest trend (Figure 5.9). Both cross sectionsillustrate that sediments outside the landfill area are more homogenous. The fat clay overlying the Suwannee Limestone was encountered in all monitoring wells offsite.

The absence of a fat clay in the vicinity of soil boring SB13 and the clay's thinness in the vicinity of test boring SB5 and monitoring well IT1 indicate there is a potential, unless blocked by the vertically upward hydraulic gradient, for surface water to infiltrate through the overlying sediments and percolate into the Floridan aquifer in these areas. Additionally, the Suwannee Limestone is higher in elevation and near the ground surface at test boring SB5 and monitoring well IT1.

Figure 5.7 illustrates that the fat clay unit was either missing or relatively thin in the south/southwestern and northeastern areas of the landfill. Thick fat clay deposits correlate with topographically higher surface elevations, and relatively thin clay deposits coincide with lower elevations.

The Hawthorn Group is unconformably overlain by the Pliocene Miccosukee Formation, consisting of very fine to course, poorly to moderately sorted, reddish-orange sands to grey sandy clays. The Hawthorn-Miccosukee contact is usually indistinguishable because of the similarity and heterogeneous nature of both formations. At the Site, the Miccosukee is found in the topographic highs, generally above 130 feet MSL, and averages about 20 feet thick.

The entire area is overlain by one to ten feet of Pleistocene and Holocene Undifferentiated Sands and Clays, which are particularly prevalent (about 10 feet thick) in low lying areas where surface runoff collects.

Madison County, Florida, is located on the north flank of the Ocala Platform (Figure 5.10). The Apalachicola Embayment tends northeastsouthwest just to the northwest of Madison County. Regional linear structures, including lakes, ponds, and marsh areas, are oriented or elongated either northeastsouthwest, or northwest-southeast. The elongated lakes are formed by surface water collecting within topographic depressions, formed by dissolution of the underlying limestone bedrock. Dissolution of the limestone occurs at a relatively faster rate in fractured areas because of the increased porosity, and resulting increased groundwater flow, in these areas.

Lineaments may be the surface expression of fractures in the underlying Suwannee Limestone. The lack of subsurface control and surface exposures makes it difficult to determine whether or not all the map lineations represent fractures. The lineament study of available photographs reveal several lineaments near the Site (See Figure 5.11). Lineaments are visible in the central and western portions of the county west of the Site; however, lineaments tend to end abruptly just east of the State Route (SR) 145. Although the exact lineaments paths may vary slightly, a lineament (linear structure) trends east-southeast through the Yard Trash Area (YTA) (See Figure 5.11).

5.2 Hydrogeology

The two hydrogeologic units present at the Site, the surficial saturated zone and the underlying Floridan aquifer, are investigated and their characteristics are discussed below.

5.2.1 Surficial Saturated Zone

One of the goals of the RI/FS was to assess the presence of a laterally continuous, permeable saturated zone that has the capability of transporting contaminants away from the landfill.

Figure 5.12 illustrates the delineation of the three saturated horizons or zones in the subsurface, one within the landfill area from 70 to 90 feet above Mean Sea Level (MSL), the other larger zone outside the landfill area from 85 to 95 feet above MSL, and

the third, and smallest zone between the other two, on top of the clay unit from 36 to 41 feet above MSL, occupying the area around IT3/SB6.

Landfill Surficial Saturated Zone: Figure 5.13 depicts the thickness of this saturated zone within the landfill. The map shows the thickest portion of the saturated zone being located beneath the trench/pond in the center of the landfill. No saturation was present along the boundary of the southern and southeastern corner of the landfill. Therefore, the edge of the saturated zone if determined to be in its permanent location would be a barrier to transport of contaminants in a lateral direction. However, the possibility of contaminant migration in the natural gas stream does exist at the landfill.

The saturated layer within the landfill has a very consistent bottom horizon of approximately 71 feet MSL. The trash cells in the landfill exist to a depth of approximately 25 feet below the surface which is approximately 75 above MSL. This saturated zone within the landfill appears to be associated with the old trash cells contained within the landfill, which are less dense and more permeable than the underlying and surrounding geologic material. Hence, water percolating downward encounters the fat clay unit underlying the landfill and is prevented from further migration. This discussion also explains why this saturated zone is limited to the area of the landfill.

The surface water pond located on site is believed to be hydrologically connected to the saturated zone within the landfill. Based upon direct observations made during significant precipitation events, the pond/trench was observed receiving substantial volumes of precipitation via surface water runoff. The pond is believed to be a source or area in which surface water has a means of entering into the shallow saturated zone underlying the landfill; however, contaminants were not found in the pond sediments. Only as the pond dries by evaporation would contaminants be carried from the landfill to the pond area, and they would be flushed back into the landfill again during the next rain.

Surficial Saturated Zones Outside the Landfill: These two zones, both to the southeast of the landfill, are at different elevations from that within the landfill; and no hydraulic connections are indicated. The elevations of the large saturated zone to the southeast overlap somewhat, but are higher than, the elevations of the saturated zone within the landfill. If there were a hydraulic connection, flow would be toward, rather than away from, the landfill. Therefore, contamination would still be contained within the landfill.

In the vertical direction near the surface, downward contaminant transport is relatively higher than horizontal transport, because surface water streams do not exist in the area. Therefore, precipitation that infiltrates into the ground moves primarily in

a vertical direction, and contamination of the Floridan aquifer, unless blocked by the upward vertical gradient from the Floridan to the surficial aquifer, could be the result of waste disposal in the surficial sediments.

5.2.2 Confining Layer

The confining layer that hydrologically separates the surficialsaturated units from the Floridan aquifer is the Hawthorn Group of sediments (Described in Section 5.1.1). Specifically, both the sandy silty clay unit and the fat clay unit of the Hawthorn Group together make up the confining layer of the area. Both units varied lithologically and in thickness throughout the study area.

During the installation of IT14S, a shelby tube soil sample was collected from the center of the silty clay unit for permeability testing. The vertical hydraulic conductivity of the silty clay is 2.9×10^{-8} cm/sec.

This value defines the silty clay unit as an aquiclude. By definition, an aquiclude is capable of storing groundwater but can only transmit it very slowly. The fat clay unit is considered to be a confining unit because its silt and sand free nature is believed to result in a vertical conductivity lower than the sandy silty clay unit. Subsurface data indicates that a confining unit of variable thickness exists under the landfill.

5.2.3 Floridan Aquifer

The Floridan aquifer is the primary hydrogeological unit of the study area. It is sealed, except possibly in local areas of collapse into solution cavities, by the Hawthorne Group of sediments, particularly by the fat clay unit. Most of the groundwater flow in the Floridan takes place in the upper 200 to 300 feet, which is characterized by numerous cavities and a high degree of secondary porosity, and is in a southeasterly direction.

Slug tests were performed at five well clusters for a total of 15 wells in order to assess the hydraulic characteristics of the Floridan aquifer at the selected well locations. Shallow, intermediate, and deep monitoring wells were tested to help assess the vertical flow component of the Floridan aquifer.

The average transmissivities at the shallow, intermediate, and deep wells (all penetrating into the Floridan aquifer) in the study area were 159, 549, and 496 square feet per day (ft[2]/d), respectively. The range of hydraulic conductivities and transmissivities computed for the Site is in the range of values established for karst limestone. The results indicate that the transmissivities and hydraulic conductivities increase with depth within the top 200 to 300 feet of the Floridan aquifer. The uppermost portion of the aquifer, having the lower transmissivity, is composed of fine grained sediment infilling irregular solution cavities; whereas, the deeper portions of the Suwannee Limestone have larger solution cavities and less fine grained sediment within these cavities.

The measurement of localized hydraulic gradients and subsequent flow velocities may not yield an accurate picture of the Floridan aquifer flow characteristics because of the heterogeneous nature of the subsurface. During the installation of wells at the Site, numerous cavities of varying size were encountered in the limestone aquifer. Figure 5.11 identifies the potential presence of a lineament in the subsurface trending through the YTA from the northwest to the southeast. Such lineaments are manifestations of the subsurface geological structure, which may be composed of many fractures, cavities, or rubble zones. A lineament suggests the existence of a preferred pathway for groundwater flow in the subsurface.

Given the many uncertainties in the heterogeneity of the aquifer material, only an estimate of the actual groundwater flow velocities in the Floridan aquifer can be made.

Horizontal Flow: Horizontal flow velocities were calculated using two separate methods. Under the first method, Darcy's Law ($v = K I$) was used to calculate a bulk velocity under the assumptions of a homogeneous and isotropic medium, and the resulting horizontal flow velocity was 14.7 feet per year (ft/yr) in a northwest to southeast direction.

A second method was based on the elapsed time from disposal of trichloroethene (TCE)/dichloroethene (DCE) in the Yard Trash Area to first appearance in the nearest point of detection in downgradient domestic wells, and the assumption that these two events were correlated. This resulted in a travel time from 1971 to 1984 over a distance of 2000 feet from northwest to southeast, or approximately 140 ft/yr. An order of magnitude increase over the Darcy's Law calculation implies the potential presence of a preferred pathway in the subsurface.

Vertical Flow: Water level measurements recorded in the monitoring wells comprising the well network indicate the presence of a vertical hydraulic gradient in the Floridan aquifer. An average upward flow gradient of 0.00326 ft/ft was obtained from well clusters screened in four zones within the Floridan aquifer. This indicates the potential for a vertical, upward groundwater flow that would tend to keep any contamination within the upper zones of the aquifer.

5.3 Groundwater Use

The Madison water supply is obtained from four wells located at three locations within the city (See Figure 1.3). These wells are approximately 2.5 miles southwest of the Madison County Landfill and are completed within the Floridan aquifer from 110 to 450 feet below the surface. Because of the large transmissivity of the Floridan, the average drawdown in the four wells is only 5 to 15 feet. Also groundwater flow in the region is from north west to south east. Based on this information, these wells are believed not to be influencing or extracting groundwater from the vicinity of the Madison County Landfill.

The Madison water supply furnishes potable water to all customers within the city and to selected residences near the landfill. These residents include the Locust Grove subdivision, located directly south of the landfill; all residences on Route 4 located directly west of the landfill; and the residences on SR-145 from the intersection of Route-4 to C-254. A well survey was performed for the private water wells located within approximately one mile downgradient of the landfill. It was determined that approximately sixty property owners within this one mile radius are using their private water wells for irrigation, and possibly other purposes.

5.4 Site Contamination

Sampling was performed in those areas with the highest potential for contamination, which included soils and groundwater on-site and at the perimeter of the landfill. Sampling was also conducted in areas which would not have been impacted by the landfill to establish background parameters near the Site. A total of three background soil, four trench, twenty-two surface soil, sixteen subsurface soil, two pond sediment, and two pond surface water samples were collected during the RI. In addition, a total of twenty-eight groundwater monitoring wells were installed at depths from fifty-six to one hundred and forty-six feet for the collection of groundwater samples. Several existing monitoring and private wells were sampled as part of the RI.

5.4.1 Groundwater Quality

Twenty-eight groundwater monitoring wells were installed at the Site in both the surficial saturated zone and the Floridan aquifer to determine the extent of groundwater contamination (Figure 5.3 illustrates well locations). Twenty-seven groundwater monitoring wells were installed during the first phase of RI field work. The final monitoring well was installed after additional data needs were identified by EPA.

Monitoring wells were completed at varying depths into the Floridan Aquifer to obtain discrete vertical groundwater data. The definition for shallow, intermediate, and deep monitoring wells is as follows:

- Shallow - To approximately 10 feet below top of rock
- Intermediate - To approximately 25 feet below top of rock
- Deep - To approximately 50 feet below top of rock

Groundwater contamination in the study area primarily involves low concentrations of halogenated volatile organic compounds (VOCs) in the Floridan aquifer at the Yard Trash Area, in the southeast corner of the landfill (Wells M1 and IT1).

The two contaminants detected in the groundwater at the greatest concentrations were TCE and cis-1,2-DCE. Other halogenated VOCs detected include chloromethane, vinyl chloride, 1,1-dichloroethene, 1,1dichloroethane, 1,1,2-trichloroethane, trichlorofluoromethane, dichlorodifluoromethane, cis-1,2-DCE, chloroform and acetone. All of these VOCs have the potential to migrate in the groundwater. As stated in the RI Report, these contaminants have not been detected in downgradient monitoring wells with the exception of TCE and cis-1,2-DCE at IT4D and chloromethane at IT11.

Table 5.1 lists a comparison of measured on-site concentrations of the identified chemicals of concern for groundwater with their respective maximum contaminant levels (MCLs), set according to the Safe Drinking Water Act and Florida's Drinking Water Standards.

Although inorganic constituents (i.e. metals) and pesticides/PCBs are present, detected concentrations were either comparable to background and health-based acceptable levels or were detected in only a single monitoring event, and therefore neither chemical type poses a threat to groundwater quality in the vicinity of the landfill. Groundwater sampling results indicate that the Floridan aquifer has been impacted by conditions at the Madison County Landfill; the contamination has migrated a short distance beyond Site boundaries, somewhat less than 1000 feet downgradient of the YTA.

5.4.2 Surface and Subsurface Soil Results

Surface and subsurface soil samples collected during the RI indicate soil contamination is present primarily within the YTA to depths less than three feet. The main contaminants detected in the YTA soil include methylene chloride, acetone, toluene, 1,1 DCE, and 1,2 DCA. Low concentrations of several semi-volatile organic compounds, and pesticides were also detected in the YTA. All detected organic chemicals, with the exception of those listed on p.6-26 of the FS Report (frequency of detection was much less than 10%), are of concern because background concentrations of these chemicals in soil is assumed to be zero. However, most concentrations of these chemicals are low. The only inorganic constituents of concern detected in the YTA soils are barium, beryllium, and cobalt.

5.4.3 Pond Surface Water and Sediment Results

Two pond surface water and two pond sediment samples were collected during the RI. No organic chemicals were detected above the detection limit in either sediment or surface water

samples. Therefore, there are no organic chemicals of concern in these media. None of the inorganic concentrations found in the pond sediments were above background concentrations, which were developed from regional data and site-specific sampling, with the exception of barium. No inorganic chemicals were above background concentrations in the surface water. Therefore, the only chemical of concern in either of these media is barium in the sediment.

5.4.4 Air Monitoring

Air monitoring data obtained during both phases of RI field work indicated that airborne volatile organic compounds (both particulate and vapor phase) were not problematic at this Site. Prior to excavation, drilling, and sampling activities, on-site workers tested the air quality with eitherDraeger Tubes, a flame ionization detector (FID), and/or an organic vapor analyzer (OVA). Instrument readings were taken continuously at each drilling location IT1 through IT8, and at the trench excavation operation. Table 5.2 presents the results of the Draeger Tube sampling. In addition, VOCs were not detected during air monitoring conducted in support of the RI Health and Safety program. Evaluation of these data supported by historical information leads to the conclusion that airborne contaminant transport is not a significant migration pathway at the Madison County Landfill Site.

6.0 Summary of Site Risks

6.1 Human Health Risks

The baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. It serves as the baseline indicating what risks could exist if no action were taken at the Site. This section of the ROD summarizes the results of the baseline risk assessment conducted for this Site. The components of the risk assessment include contaminant identification, exposure assessment, toxicity assessment, and a risk characterization.

6.1.1 Contaminant Identification

At the Madison County Landfill Site the following media were assessed for contamination: groundwater, surface soil, surface water (intermittent pond), and sediment (pond).

For each contaminant of concern in a given medium, an exposure point concentration was determined by calculating the statistical upper confidence limit (UCL) of the sample results. If too few data were available to calculate a UCL, the maximum detected value was used as the exposure point concentration. Exposure point concentrations are shown for all contaminants of concern in groundwater and surface soil in Tables 6.1 and 6.2. Levels of

chemicals in the pond (water and sediment) were determined to be insignificant in regard to potential human exposure.

6.1.2 Exposure Assessment

Currently the Site is a municipal landfill, surrounded by rural residential and agricultural land. For the current scenario, it was assumed that a child trespasses the Site on a regular basis. Since some of the nearby private wells have shown contamination (necessitating the providing of municipal water to these residents), exposure to the groundwater at the perimeter of the Site was determined to be a current pathway as well. Because of the land use of the surrounding area, it is possible that in the future the Site could become residential/agricultural if deed restrictions are not enacted and enforced at the time of the landfill closure. Therefore, the baseline risk assessment assumed that residents would live in the most contaminated area of the Site in the future use scenario. Assumptions included exposure to site groundwater and surface soil by the future hypothetical resident. The future scenario also included residential consumption of beef, vegetables and fruit grown on the Site, as well as consumption of milk produced from beef grown on the Site, but these pathways did not result in significant risks. The exposure assumptions used for groundwater and surface soil are shown in Tables 6.3 and 6.4.

6.1.3 Toxicity Assessment

Under current EPA guidelines, the likelihood of adverse effects to occur in humans from carcinogens and noncarcinogens are considered separately. These are discussed below.

Carcinogens: EPA uses a weight-of-evidence system to classify a chemical's potential to cause cancer in humans. All evaluated chemicals fall into one of the following categories: Class A - Known Human Carcinogen; ClassB - Probable Human Carcinogen (B1 means there is limited human epidemiological evidence, and B2 means there is sufficient evidence in animals and inadequate or no evidence in humans); Class C - Possible Human Carcinogen; Class D - Not classifiable as to Human Carcinogenicity; and Class E - Evidence of noncarcinogenicity for Humans.

Cancer Slope Factors (SFs), indicative of carcinogenic potency, are developed by EPA's Carcinogenic Assessment Group to estimate excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" refers to the conservative

estimate of the risks calculated from the SF. This approach makes underestimation of the actual cancer risk highly unlikely.

Table 6.5 lists cancer classifications and slope factors for carcinogenic contaminants of concern which had calculated risks exceeding 1E-6.

Noncarcinogens: Reference Doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects other than cancer. RfDs, which are expressed in units of mg/kg-day, are estimates of chronic daily exposure for humans, including sensitive individuals, that are thought to be free of any adverse effects. RfDs are derived from human epidemiological data or extrapolated from animal studies to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. Estimated intake of chemicals from environmental media can be compared to the RfD for each of the contaminants.

Table 6.6 lists the oral RfDs for all contaminants of concern which resulted in hazard quotient of greater than 0.1. No inhalation reference doses have been verified for any of these chemicals.

6.1.4 Risk Characterization Summary

Excess lifetime cancer risks are determined by multiplying the chronic daily intake (CDI) by the slope factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1 x 10[-6] or 1E06). An excess lifetime cancer risk of 1E-06 indicates that, as an upperbound estimate, an individual has a one in one million additional chance of developing cancer in his/her lifetime as a result of exposure to a site related carcinogen under the specific exposure conditions at a site.

The potential for noncarcinogenic effects from a single contaminant in a single medium is expressed as a hazard quotient (HQ). The HQ is the ratio of the estimated human intake to the RfD for a particular contaminant. By adding the HQs for all contaminants within a medium and then across all media to which a given population may reasonably exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for assessing the potential significance of exposure to multiple contaminants across multiple media.

The estimated total carcinogenic risks for the 30 year exposure to groundwater by an adult in the current land use scenario was 2.2E-6. The maximum risk from oral exposure to any single chemical was 7.5E-7. For the future residential scenario of adult exposure to groundwater, the estimated carcinogenic risk was 2.5E-3. The HI for this exposure scenario was estimated to be 9.2. Individual chemical risks which exceeded 1E-6 and HQs which exceeded 0.1 are shown on Tables 6.7 and 6.8.

The estimated carcinogenic risks for exposure to surface soil were below 1E-6 for the current use scenario of a trespasser as well as for the future hypothetical residential exposure. The total estimated HI for the trespasser in the current use scenario was less than 0.1. For exposure to surface soil in the future use residential scenario, the total His were:

- 0.16 for a resident child, age 1 through 5

- 0.02 for a resident adult, 30 year exposure

EPA's targeted carcinogenic risk range for cleanup of Superfund sites is 1E-04 TO 1E-06. Risks less than 1E-06 are deemed acceptable and those greater than 1E-04 are unacceptable to EPA. Risks that fall between 1E-04 and 1E-06 may or may not warrant action, depending on site-specific factors considered by the risk manager. Noncarcinogenic HI values greater than 1.0 indicate that remedial action should be taken. Therefore, the only identified contamination which poses unacceptable risks is that of the volatile organic compounds (VOCs) present in the groundwater.

The risk assessment process contains inherent uncertainties. Exposure parameters such as frequency and duration of exposure and ingestion rate of contaminated media can vary between individuals. Therefore, upperbound values were used to estimate exposure, in order to be more protective of human health. Slope factors and Reference Doses each involve extrapolation to which conservative uncertainty factors are added in order to be protective of sensitive humans. Thus, the risk characterization process strives to minimize the probability that uncertainties may result in an underestimation of the actual health risks that could result from human exposure to thesite.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.2 Environmental (Ecological) Risks

About half of the soon to be closed landfill is barren of vegetative cover at present. Pine trees have been planted on closed cells. Some small stands of mixed pine and hardwood as well as pasture and open fields border the landfill property. It is expected that succession will take place on the landfill in the years following closure with hardwoods gradually replacing the pines. A catchment pond is located on the landfill site and contains some stocked catfish.

A quantitative risk characterization was performed for potentially exposed birds and mammalian wildlife at the Site. This was done by comparison of conservatively estimated daily doses with published acceptable chronic daily doses of detected chemicals to calculate a hazard quotient (HQ). None of the calculated HQs exceeded the target value of 1.0. Therefore, it appears that the site related contamination does not pose a significant hazard to birds or mammals that might frequent the Site.

7.0 Description of Remedial Action Alternatives

The Feasibility Study Report presents the results of a detailed analysis conducted on four potential remedial action alternatives for the Madison County Landfill Site. This section of the Record of Decision presents a summary of each of the four alternatives that are described in the FS Report. Alternative numbering corresponds with the FS Report.

Alternative 1 - No Action

Alternative 3 - Institutional Actions, Groundwater Extraction, Treatment (Air Stripping and Granular Activated Carbon - GAC), and Reinjection

Alternative 6 - Institutional Actions, Cap Entire Site, Groundwater Extraction, Treatment (Air Stripping and GAC), and Reinjection

Alternative 7 - Institutional Actions, Cap YTA Only, Groundwater Extraction, Treatment (Air Stripping and GAC), and Reinjection

7.1 Alternative 1 - No Action

The National Contingency Plan (NCP) requires the development of a no action alternative as a basis for comparing other alternatives. Therefore, this alternative would mean no action would be taken to reduce the risks posed by source and groundwater contamination at the Site. No restrictions would be placed on future use of groundwater and no future monitoring would be performed. Reduction of contamination would take place only by natural processes.

This alternative would not comply with the preference for treatment pursuant to SARA; however, through natural processes, such as dispersion and attenuation, it would eventually achieve compliance with federal MCLs over a period of time that is in excess of 1,000 years. This alternative would not prevent the potential migration of contaminants off-site via surface water or sediment transport, or leaching of contaminants from the landfill to the Floridan aquifer. In fact, this alternative would allow for the continued risk of exposure to contaminated groundwater should someone install a potable water supply well directly in the source area.

Since no action is required, this alternative is easily implemented with no associated costs.

7.2 Alternative 3 - Institutional Actions, Extraction Wells, Air Stripping, Carbon Adsorption (GAC), and Reinjection

Major Components of Remedial Alternative:

This alternative utilizes a groundwater extraction system with the extracted groundwater being treated by air stripping and granular activated carbon (GAC). Based upon the Floridan aquifer groundwater flow characteristics described in the RI Report, collection of the contaminated groundwater is feasible using a groundwater extraction system. The extraction system could be a single well or multi-well installation; the type used would be determined during remedial design. This remedial alternative consists of the following components:

- Institutional actions;

- Construction of extraction wells;

- Installation of groundwater treatment and discharge (reinjection) system; and

- Construction of a stormwater management system.

Figure 7.1 is a site map depicting the facilities associated with Alternative 3 and the land areas that would be affected. The creation of three zones:

- a groundwater recovery zone,

- a treated groundwater reinjection zone, and

- a stormwater retention area

would require acquisition of approximately 4 to 6 acres of property adjacent to the existing landfill boundary.

Alternative 3 also includes, but is not limited to the following institutional actions, which would be implemented by the state and local government agencies:

- Access restrictions in the form of fences and signs around the landfill;

- Restrictions on future use of the Site to prevent construction of water supply wells and construction on-site that would require excavation;

ù Land use ordinances or other measures restricting construction of water supply wells off-site in the vicinity of the landfill; and

- Groundwater monitoring.

Access restrictions would be required in order to prevent contact with the contaminated media. These restrictions may include fences and signs around the Site, as well as land use ordinances and deed restrictions. The current site owner, Madison County,

would be required to conduct an inspection of the existing fence surrounding the landfill and perform any work necessary to make the existing fence complete and provide on going maintenance of the fence, as required by Section 403.7255, Florida Statutes and Rule 17-736, F.A.C.. Also, this rule requires PRPs to supply, install and maintain warning signs at the Site.

Both deed restrictions and land use ordinances may be used by state and local government agencies to notify land owners that groundwater contamination exists beneath the property and prohibit the construction of new water supply wells in the affected area. A deed restriction, which is a negotiated addendum to an existing deed that indicates that the groundwater resource below and in close proximity to the property is not considered safe for potable or other uses, notifies the existing property owner and any subsequent owners of the groundwater condition during the time the aquifer is not usable. Additionally, restrictions on future use of the Site and the area immediately downgradient of the YTA would prevent construction of new water supply wells and prohibit construction that would require excavation on the site property.

Restricting the use of groundwater in the potentially affected area can be accomplished by dividing the area into two control zones as shown in Figure 7.2:

- Control zone 1 is a 3,000-feet wide corridor with a depth that begins at monitoring well IT-1 and extends to monitoring well IT-3. The construction of new water supply wells within control zone 1 would be prohibited. No water supply wells currently exist in control zone 1.

- Control zone 2 is a 3,000-feet wide corridor situated between monitoring well IT-3 and extends to a depth of 3,000 feet downgradient of monitoring well IT-1. Initially, no restrictions would be imposed for groundwater within control zone 2. However, in the event that subsequent monitoring indicates the presence of contaminant levels above MCLs, the restrictions applied to control zone 1 would also be imposed on control zone 2.

Should additional domestic water supply wells in either zone show contamination during the monitoring period, the owners would be notified and would be provided with the opportunity to hook-up to City water in order to prevent further exposure to the contaminated groundwater. The restrictions on use of the aquifer would not be required after EPA certifies achievement of the performance standards specified in Section 8.1.2.

Groundwater monitoring would be conducted to periodically assess the degree and extent of groundwater contamination. Monitoring wells M-2, M-5, IT-13 and monitoring well clusters IT-1, IT-2, IT-3, IT-4, IT-6, and IT-7 would be monitored quarterly for the

chemicals of concern for a period of 25 years or until it is determined that monitoring is no longer needed. Based on the sampling results generated, EPA may at some point determine that a less frequent monitoring schedule is appropriate.

A review of the Madison County Landfill site history indicates thatthe chemicals of concern were transported about 1,500 to 2,000 feet in the 14 year period between 1971 and 1985. Data results show that the annual average values of TCE and DCE are currently approaching the federal/state Maximum Contaminant Levels (MCLs), which are the accepted health-based concentrations allowed in groundwater used as a drinking source, and that vinyl chloride concentrations have stabilized. Assuming that this observed trend in attenuation continues, a 25 year period of monitoring downgradient wells should be adequate to monitor and document the attainment of MCL concentrations in groundwater.

A groundwater extraction system would be effective in capturing contaminants entering the Floridan aquifer in the vicinity of the YTA. Using the numerical model "MOC" (Appendix B of the FS Report), a one-well extraction system (It would be determined during remedial design whether a single-well or multi-well extraction system would be utilized) screened from the top of the limestone to approximately 50 feet into the limestone, pumping a total of 250 gallons per minute (gpm) could effectively extract the contaminated groundwater. The extracted groundwater would be pumped through a treatment system (air stripper and carbon adsorption, GAC unit) and discharged into one or more reinjection wells located downgradient of the extraction well system. If a reinjection well permit is not attainable other process options such as infiltration, irrigation and/or direct discharge may be introduced and further developed as discharge options.

Summary of Remedial Alternative Evaluation:

The technologies included in Alternative 3 are conventional and all necessary equipment is readily available for implementation. Air stripping and carbon adsorption have been successfully used for removing similar contaminants from groundwater at several remediation sites in Florida. Spent carbon would be sent for recycling at a designated GAC regeneration facility whereadsorbed contaminants would be thermally treated.

Technically, all of the processes making up this alternative can be constructed, operated and maintained without any unusual difficulty; however, administrative difficulties could be anticipated. First, difficulties could arise in the acquisition of the required acreage necessary for the construction of the stormwater management system. Second, the substantive requirements of a consumptive use permit from the Suwannee River Water Management District to install the necessary extraction well system would have to be met. Meeting the requirements of a consumptive use permit is feasible. However, discharge of the treated groundwater could require compliance with other requirements as follows:

- If the contaminated groundwater is a characteristic hazardous waste (exceeding 500 ug/l TCE) under RCRA, the treated groundwater would be prohibited from being reinjected into the Floridan aquifer without treatment under the provisions of Chapter 17-28, F.A.C. Treatment of groundwater to consistently reduce concentrations of TCE to below the Florida drinking water standards is feasible.

- Treated groundwater would be monitored to ensure that DCE/TCE concentrations are reduced sufficiently and consistently. The provisions of the monitoring plan could have a decisive impact on the feasibility of the basic alternative.

- If reinjection of the treated groundwater could not be implemented, then an alternative pathway for disposal of the effluent from treatment would be necessary. The political and administrative issues that may be encountered are unknown. Reuse of treated groundwater in the State of Florida is a preferred alternative under FDER policy and may offer an opportunity to secure the remedial benefits of Alternative 3 without contaminating the Floridan aquifer. Irrigation and infiltration are potential alternate process options for discharging treated groundwater and may be combined into this alternative, if a reinjection permit can not be obtained.

Based on a cursory evaluation of the anticipated emissions from the air stripper, air emission controls may not be necessary. However, a pre-construction review by FDER of the proposed air stripper would be necessary under the provisions of Chapter 403, Florida Statutes, and Chapter 17-2, F.A.C. An air permit would not be necessary as this would be an on-site action under CERCLA; however, the substantive requirements of such a permit must be met.

Because the reinjection zone is located off-site, construction and use of reinjection wells would require a permit or variances from FDER, pursuant to Chapter 17-28, F.A.C. which governs underground injection. The treated groundwater would have to meet Florida's Drinking Water Standards prior to reinjection. The time required for construction (not implementation) of this alternative is conservatively estimated to be approximately 2 years from completion of the remedial design.

This alternative would have the potential to achieve the Remedial Action Objectives (RAOs), including the achievement of the federal and state MCLs, and be protective of the environment and human health. The extraction system would have the capability to remediate the contaminated groundwater for an approximate 175,000 square foot area around the southeast corner of the YTA.

The estimated time for this system to meet RAOs at the point of compliance (500 feet downgradient of monitoring well IT-1) is estimated to range from 3 to 5 years. The estimated time includes the time required for construction of the alternative (0.5 to 2 years), the time for remediation of the aquifer (approximately 1.5 years based on modeling results) and the time required for four quarterly monitoring events (1 year).

The estimated capital costs to be expended over a one to two year period of construction as presented in the FS are estimated to be $3,037,000. Operation & Maintenance (O&M) costs to be expended over a period of 25 years range between $418,600 and $388,600, annually. The annual O&M costs are relatively higher for this alternative because leachate generation from the YTA would continue and, as a result, the pump and treatment system would continue to operate until all contaminants of concern have leached out of the YTA soil; this is estimated to take an additional 15 years of system operation. The estimated total present worth cost as presented in the FS would be $7,082,200.

It is noted that for purposes of comparability and practicality, capital and present worth costs were based on the installation of a single-well extraction system and a two-well reinjection system. The actual number and placement of the wells within each system would be determined during remedial design. If EPA determines that more wells are necessary, the cost would increase accordingly.

7.3 Alternative 6 - Institutional Actions, Cap Entire Site, Extraction Wells, Air Stripping, Carbon Adsorption (GAC), and Reinjection

Major Components of Remedial Alternative:

This alternative is identical to Alternative 3 with the addition of the construction of a clay/soil cap over approximately 52 acres of the Site to include all former closed waste cells. Alternative 6 utilizes a groundwater extraction system with the extracted groundwater being treated by air stripping and granular activated carbon (GAC). The extraction system could be a single well or multi-well installation; the type used would be determined during remedial design. This remedial alternative consists of the following components as shown in Figure 7.3:

. Institutional actions;

ù Construction of clay/soil cap over 52 acres;

. Installation of a passive gas collection and control system;

. Construction of extraction wells;

. Installation of groundwater treatment and discharge (reinjection) system; and

. Construction of a stormwater management system.

Madison County already has been ordered by FDER to close the most recently active waste cell ("the active cell") located on the northerly portion of the landfill (approximately 9.5 acres, shown in Figure 7.3). This closure includes construction of a soil/clay cap designed and constructed in accordance with Rule 17-701, F.A.C., standards. Because Madison County is already required to complete closure of the active cell before CERCLA remedial action at the Site is likely to be implemented, closure of the active cell is not included in this alternative. This alternative is intended to address the possibility that contaminants could be released to groundwater from previously closed waste cells within the Site.

The capping component of Alternative 6 includes capping approximately 52 acres of land already closed in accordance with Rule 17-701, F.A.C., including the YTA. The acreage of previously closed waste cells have been identified in Madison County's Landfill Closure Plan prepared by DeRabi and Associates. Alternative 6 consists of the following components as shown in Figure 7.3:

. Acquisition of approximately 43 acres of land for borrow and construction of the necessary stormwater impoundment. From information obtained from the Madison County plat map, the acreage could be obtained in three parcels, one from each of three adjacent land owners. Depending upon the configuration of facilities that would be required for Alternative 6, the parcels to be acquired could be:

    - Two smaller parcels, each ranging from approximately 2 to 6 acres in areas from land east of the YTA; and

- One parcel of approximately 30 to 40 acres from land south of the YTA.

- Site Preparation including clearing and grubbing the previously closed waste cells, the YTA, and borrow area (a total of approximately 95 acres).

- Installation of a clay/soil cap that would connect with the County installed cap, but would require filling of the County's existing stormwater management unit (surface pond) and the transfer of this function to the newly constructed stormwater control facilities that serve the entire Site.

- Construction of new stormwater control facilities (dikes, impoundment, and drainage ditches) to serve the entire Site, requiring approximately 140 acre-ft capacity. Stormwater would be stored in a facility constructed in the borrow area located south of the YTA.

- Installation of a passive gas collection and control system.

- Construction of a groundwater extraction well system.

- Installation of a groundwater treatment system that would include an air stripper and two GAC columns in series.

- Installation of reinjection well(s) into the Floridan aquifer.

Alternative 6 also includes, but is not limited to the institutional actions listed as follows which would be implemented by state and local government agencies:

- Access restrictions in the form of fences and signs around the Site;

- Restrictions on future use of the Site to prevent construction of water supply wells and construction on-site that would require excavation;

- Land use ordinances or other measures restricting construction of water supply wells off-site in the vicinity of the landfill; and

- Groundwater monitoring.

Each action is fully described under Alternative 3 in Section 7.2, Components of Remedial Alternative. As with Alternative 3, restricting the use of groundwater in the potentially affected area can be accomplished by dividing the area into two control zones as shown in Figure 7.3:

- Control zone 1 is a 3,000-feet wide corridor with a depth that begins at monitoring well IT-1 and extends to monitoring well IT-3. The construction of new water supply wells within control zone 1 would be prohibited. No water supply wells currently exist in control zone 1.g

. Control zone 2 is a 3,000-feet wide corridor situated between monitoring well IT-3 and extends to a depth of 3,000 feet downgradient of monitoring well IT-1. Initially, no restrictions would be imposed for groundwater within control zone 2. However, in the event that subsequent monitoring indicates the presence of contaminant levels above MCLs, the restrictions applied to control zone 1 would also be imposed on control zone 2.

Should additional domestic water supply wells in either zone show contamination during the monitoring period, the owners would be notified and would be provided with the opportunity to hook-up to City water in order to prevent further exposure to the contaminated groundwater. The restrictions on use of the aquifer would not be required after EPA certifies achievement of the performance standards specified in Section 8.1.2.

Groundwater monitoring would be conducted to periodically assess the degree and extent of groundwater contamination. Monitoring wells M-2, M-5, IT-13 and monitoring well clusters IT-1, IT-2, IT-3, IT-4, IT-6 and IT-7 would be monitored quarterly for the chemicals of concern for a period of 25 years or until it is determined that monitoring is no longer needed. Based on the sampling results generated, EPA may at some point determine that a less frequent monitoring schedule is appropriate.

A review of the Madison County Landfill site history indicates that the chemicals of concern were transported about 1,500 to 2,000 feet in the 14 year period between 1971 and 1985. Data results show that the annual average values of TCE and DCE are currently approaching the federal/state Maximum Contaminant Levels (MCLs), which are the accepted health-based concentrations allowed in groundwater used as a drinking source, and that vinyl chloride concentrations have stabilized. Assuming that this observed trend in attenuation continues, a 25 year period of monitoring downgradient wells should be adequate to monitor and document the attainment of MCL concentrations in groundwater.

The process options forming Alternative 6 allow the source of contamination to be contained while lowering the levels of contaminants in the contaminated groundwater. The capping component reduces the volume of leachate generated, thus reducing the further contamination of the aquifer.

To facilitate capping of the presently closed waste cells, most of the Site would be cleared and grubbed. Clearing the Site would involve removing all surface materials including shrubs, trees, and debris from approximately 52 acres to be capped and the surface of the borrow area. Approximately a total of 95 acres would have to be cleared and grubbed. After construction of the new stormwater management facilities, the present pond would be drained and filled with compacted soil.

The cap material would be selected in accordance with Rule 17-701, F.A.C. and would consist of multiple layers of compacted clay soil and top soil. The capped area would be graded so that surface water run-off is directed to the stormwater collection system. The construction of a low permeability cap over the landfilled material could result in a build up of VOCs or methane. Therefore, a passive gas collection and control system would also be installed as part of this alternative.

A new stormwater management system would be installed to manage site run-off, protect the treatment system and reinjection well(s) from surface water inflow and prevent run-off of contaminated stormwater from the remedial project construction activity. The installation of this stormwater management system would require the acquisition of property around the perimeter of the Site (See Figure 7.3).

A groundwater extraction system would be effective in capturing contaminants entering the Floridan aquifer in the vicinity of the YTA. Using the numerical model "MOC" (Appendix B of the FS Report), a single-well extraction system (It would be determined during remedial design whether a single-well or multi-well extraction system would be utilized) screened from the top of the limestone to approximately 50 feet into the limestone, pumping a total of 250 gallons per minute (gpm) could effectively extract the contaminated groundwater. The extracted groundwater would be pumped through a treatment system (air stripper and GAC unit) and discharged into one or more reinjection wells located downgradient of the extraction well system. If a reinjection well permit is not attainable other process options such as spray irrigation, infiltration or direct discharge may be introduced and further developed as discharge options.

Summary of Remedial Alternative Evaluation:

The technologies included in Alternative 6 are conventional and all necessary equipment is readily available for implementation. Air stripping and carbon adsorption have been successfully used for removing similar contaminants from groundwater at several remediation sites in Florida. Spent carbon would be sent for recycling at a designated GAC regeneration facility where adsorbed contaminants would be thermally treated.

Alternative 6 is expected to be effective in stopping the release of contaminated leachate into the downgradient aquifer and would substantially reduce the levels of contaminants in the groundwater.

Technically, all of the processes making up this alternative can be constructed, operated and maintained without any unusual difficulty; however, administrative difficulties could be anticipated. First, this alternative would require that a large area of land be acquired in order to construct the stormwater management system and other components of the remedial alternative. Acquiring the needed property and enacting the required ordinances prohibiting construction and use of water supply wells could present some difficulty. Second, the substantive requirements of a consumptive use permit from the SRWMD to construct the extraction system would have to be met. Meeting the requirements of a consumptive use permit is feasible. However, discharge of the treated groundwater could require compliance with other requirements as described under Alternative 3, Section 2.7, Summary of Remedial Alternative Evaluation.

Based on a cursory evaluation of the anticipated emissions from the air stripper, air emission controls may not be necessary. However, a pre-construction review by FDER of the proposed air stripper wouldbe necessary under the provisions of Chapter 403, Florida Statutes, and Chapter 17-2, F.A.C. An air permit would not be necessary as this would be an on-site action under CERCLA; however, the substantive requirements of such a permit must be met.

Because the reinjection zone is located off-site, construction and use of reinjection wells would require a permit or variances from FDER, pursuant Chapter 17-28, F.A.C. which governs underground injection. Treated groundwater would have to meet Florida's Drinking Water Standards prior to reinjection. The time required for construction (not implementation) of this alternative is conservatively estimated to be approximately 2 years.

This alternative would have the potential to achieve the Remedial Action Objectives (RAOs), including the achievement of federal and state MCLs, and be protective of the environment and human health. The extraction system would have the capability to remediate the contaminated groundwater for an approximate 175,000 square foot area around the southeast corner of the YTA.

The institutional measures included in Alternative 6, if continuously enforced by the state and local government agencies, would be protective of human health during the period of remediation. The time estimated for this alternative to meet RAOs at the point of compliance is estimated to range between 3 and 5 years. The estimated time includes the time required for construction of the alternative (0.5 to 2.5 years), the time for remediation of the aquifer (approximately 1.5 years based on modeling results) and the time required for four quarterly monitoring events (1 year).

The estimated capital costs to be expended over a one to two year period of construction as presented in the FS are estimated to be $18,390,940. O&M costs to be expended over a period of 25 years are estimated to range between $409,600 and $109,600, annually. The estimated total present worth cost as presented in the FS would be $20,136,200. It is noted that for purposes of comparability and practicality, capital and present worth costs were based on the installation of a single-well extraction system and a two-well reinjection system. The actual number and placement of the wells within each system would be determined during remedial design. If EPA determines that more wells are necessary, the cost would increase accordingly.

During the first 3 - 5 years, the pump and treatment system would be constructed and operated. After that time period, the treatment system would be shut down thereby lowering O&M costs for the remaining years. The O&M costs remaining would be that associated with groundwater monitoring.

7.4 Alternative 7 - Institutional Actions, Cap YTA, Extraction Wells, Air Stripping, Carbon Adsorption (GAC), and Reinjection.

Major Components of Remedial Alternative:

Alternative 7 is identical to Alternative 3 with the addition of an approximate 5-acre cap over the YTA portion of the landfill. Alternative 7 consists of institution actions, groundwater extraction/treatment, and reinjection in conjunction with capping of the YTA. This combination of technologies is intended to control the source of contamination while remediating the contaminated groundwater. Alternative 7 utilizes a groundwater extraction system with the extracted groundwater being treated by air stripping and granular activated carbon (GAC). The extraction system could be a single well or multi-well installation; the type used would be determined during remedial design. Consequently, Alternative 7 consists of the following components as shown in Figure 7.4:

- Installation of a clay/soil cap over the YTA;
- Construction of stormwater control facilities such as dikes, impoundments, and drainage ditches;
- Construction of a groundwater extraction well system;
- Installation of a groundwater treatment system including an air stripper and two GAC columns; and
- Installation of reinjection well(s) into the Floridan aquifer.

Alternative 7 also includes, but is not limited to the following institutional measures which would be implemented by state and local government agencies:

- Access restrictions in the form of fences and signs around the Site;
- Restrictions on future use of the Site to prevent construction of water supply wells and construction on-site that would require excavation;
- Land use ordinances or other measures restricting construction of water supply wells off-site in the vicinity of the landfill; and
- Groundwater monitoring.

Each action is fully described under Alternative 3 in Section 7.2, Components of Remedial Alternative. As with Alternative 3, restricting the use of groundwater in the potentially affected

area can be accomplished by dividing the area into two control zones as shown in Figure 7.4:

- Control zone 1 is a 3,000-feet wide corridor with a depth that begins at monitoring well IT-1 and extends to monitoring well IT-3. The construction of new water supply wells within control zone 1 would be prohibited. No water supply wells currently exist in control zone 1.
- Control zone 2 is a 3,000-feet wide corridor situated between monitoring well IT-3 and extends to a depth of 3,000 feetdowngradient of monitoring well IT-1. Initially, no restrictions would be imposed for groundwater within control zone 2. However, in the event that subsequent monitoring indicates the presence of contaminant levels above MCLs, the restrictions applied to control zone 1 would also be imposed on control zone 2.

Should additional domestic water supply wells in either zone show contamination during the monitoring period, the owners would be notified and would be provided with the opportunity to hook-up to City water in order to prevent further exposure to the contaminated groundwater. The restrictions on use of the aquifer would not be required after EPA certifies achievement of the performance standards specified in Section 8.1.2.

Groundwater monitoring would be conducted to periodically assess the degree and extent of groundwater contamination. Monitoring wells M-2, M-5, IT-13 and monitoring well clusters IT-1, IT-2, IT-3, IT-4, IT-6 and IT-7 would be monitored quarterly for the chemicals of concern for a period of 25 years or until it is determined that monitoring is no longer needed. Based on the sampling results generated, EPA may at some point determine that a less frequent monitoring schedule is appropriate.

A review of the Madison County Landfill site history indicates that the chemicals of concern were transported about 1,500 to 2,000 feet in the 14 year period between 1971 and 1985. Data results show that the annual average values of TCE and DCE are currently approaching the federal/state Maximum Contaminant Levels (MCLs), which are the accepted health-based concentrations allowed in groundwater used as a drinking source, and the vinyl chloride concentrations have stabilized. Assuming that this observed trend in attenuation continues, a 25 year period of monitoring downgradient wells should be adequate to monitor and document the attainment of MCL concentrations in groundwater. The process options forming Alternative 7 allow the source of contamination to be contained while lowering the levels of contaminants in the contaminated groundwater. The capping component reduces the volume of leachate generated, thus reducing the further contamination of the aquifer.

To facilitate capping of the southeast corner of the landfill, the YTA and areas where the stormwater management facilities are to be constructed would be cleared and grubbed. Clearing the Site would involve removing all surface materials including shrubs, trees, and debris. Approximately 11 acres would have to be cleared and grubbed.

The YTA cap material would be selected in accordance with Rule 17701, F.A.C. and would consist of multiple layers of compacted clay soil and top soil. The capped area would be graded so that surface water run-off is directed to the stormwater collection system.

Since Alternative 7 only provides for capping of the YTA, where vegetative yard trash and construction debris were placed, no significant generation of methane gas would be anticipated in conjunction with capping of the YTA, therefore, no passive gas collection/control system should be necessary.

A stormwater management system would be installed to manage stormwater run-off in the vicinity of the YTA, protect the treatment system and reinjection well(s) from surface water inflow and prevent run-off of contaminated stormwater from the remedial project construction activity. The installation of this stormwater management system would require the acquisition of approximately 6 acres of property immediately south and east of the YTA.

Groundwater would be extracted at approximately 250 gpm using submersible centrifugal pumps from an extraction well system installed on the southeast corner of the YTA. The extracted groundwater would be pumped through a treatment system (air stripper and GAC unit) and discharged into one or more reinjection wells located downgradient of the extraction well system. If a reinjection well permit is not attainable other process options such as irrigation, infiltration or direct discharge may be introduced and further developed as discharge options.

Summary of Remedial Alternative Evaluation:

The technologies of Alternative 7 are conventional and all necessary equipment is readily available for implementation. Air stripping and carbon adsorption have been successfully used to remove similar contaminants from groundwater at several remediation sites in Florida. Spent carbon would be sent for recycling at a designated GAC regeneration facility where adsorbed contaminants would be thermally treated.

Alternative 7 would be effective in reducing the release of contaminated leachate into the downgradient aquifer and would remediate contaminated groundwater in the immediate vicinity of IT-1. During the period of remediation, the institutional measures included in Alternative 7, if continuously enforced, would be protective of human health.

Technically, all of the processes making up this alternative can be constructed, operated and maintained without any unusual difficulty; however, administrative difficulties could be anticipated. First, this alternative would require that approximately 6 acres of land be acquired in order to construct the stormwater management system and other components of the remedial alternative. Acquiring the needed property and enacting the required ordinances prohibiting construction and use of water supply wells could present some difficulty. Second, the substantive requirements of a consumptive use permit from the SRWMD to construct the extraction system would have to be met. Meeting the requirements of a consumptive use permit is feasible. However, discharge of the treated groundwater could require compliance with other requirements as described under Alternative 3, Section 2.7, Summary of Remedial Alternative Evaluation.

Based on a cursory evaluation of the anticipated emissions from the air stripper, air emission controls may not be necessary. However, a pre-construction review by FDER of the proposed air stripper would be necessary under the provisions of Chapter 403, Florida Statutes, and Chapter 17-2, F.A.C. An air permit is not necessary as this would be an on-site action under CERCLA; however, the substantive requirements of such a permit must be met.

Because the reinjection zone is located off-site, construction and use of reinjection wells would require a permit or variances from FDER, pursuant Chapter 17-28, F.A.C. which governs underground injection. Treated groundwater would have to meet Florida's Drinking Water Standards. The time required for construction (not implementation) of this alternative is conservatively estimated to be approximately 2 years.

This alternative would have the potential to achieve the Remedial Action Objectives (RAOs), including the achievement of federal and state MCLs, and be protective of the environment and human health. The extraction system would have the capability to remediate the contaminated groundwater for an approximate 175,000 square foot area around the southeast corner of the YTA.

The estimated time for this system to meet RAOs at the point of compliance (500 feet downgradient of monitoring well IT-1) is estimated to range between 3 to 5 years. The estimated time includes the time required for construction of the alternative (0.5 to 2.5 years), the time for remediation of the aquifer (approximately 1.5 years based on modeling results) and the time required for four quarterly monitoring events (1 year).

The estimated capital costs to be expended over a one to two year period of construction are estimated to be $3,445,750. O&M costs to be expended over a period of 25 years range between $409,600 and 109,600, annually. The estimated total present worth cost as presented in the FS would be $5,191,000. It is noted that for purposes of comparability and practicality, capital and present worth costs were based on the installation of a single-well extraction system and a two-well reinjection system. The actual number and placement of the wells within each system would be determined during remedial design. If EPA determines that more wells are necessary, the cost would increase accordingly.

During the first 3 - 5 years, a pump and treatment system would be constructed and operated. After that time period, the treatment system would be shut down thereby lowering O&M costs for the remaining years. The O&M costs remaining would be that associated with groundwater monitoring.

8.0 Comparative Analysis of Remedial Action Alternatives

A detailed comparative analysis was performed on the four (4) remedial alternatives developed during the FS using the nine evaluation criteria set forth in the NCP. The advantages and disadvantages of each alternative were compared to identify the alternative with the best balance among these nine criteria. A glossary of the evaluation criteria is provided in Table 8.1. According to the NCP, the first two criteria are labeled "Threshold Criteria", relating to statutory requirements that each alternative must satisfy in order to be eligible for selection. The next five criteria are labeled "Primary Balancing Criteria", which are technical criteria upon which the detailed analysis is primarily based. The final two criteria are known as "Modifying Criteria", assessing the public's and State agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of the specific alternative.

A summary of the relative performance of each alternative with respect to the nine evaluation criteria and each other is provided in the following subsections.

8.1 Threshold Criteria

8.1.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

All of the alternatives, with the exception of the "No Action" alternative, would provide protection of human health and the environment by eliminating, reducing or controlling risk through treatment of groundwater contaminants, engineering controls, and/or institutional controls. Since the no action alternative does not eliminate, reduce or control any of the exposure

TABLE 8.1

GLOSSARY OF EVALUATION CRITERIA

THRESHOLD CRITERIA:

Overall Protection of Human Health and the Environment - addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls or institutional controls.

Compliance with ARARs - addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and/or provides grounds for invoking a waiver.

PRIMARY BALANCING CRITERIA:

Long-Term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Reduction of Toxicity, Mobility, or Volume Through Treatment addresses the anticipated performance of the treatment technologies that may be employed in a remedy.

Short-Term Effectiveness - refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

Implementability - is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Cost - includes capital and operation and maintenance costs.

MODIFYING CRITERIA:

State Acceptance - indicates whether the State concurs with, opposes, or has no comment on the Proposed Plan.

Community Acceptance - the Responsiveness Summary in the appendix of the Record of Decision reviews the public comments received from the Proposed Plan public meeting and the public comment period. pathways, it is deemed not protective of human health or the environment.

Alternative 1 poses no additional short-term risks to either human health or the environment, yet overall it provides no protection. Each of the remaining alternatives, 3, 6 and 7, would provide adequate protection under both present and future conditions, by preventing the migration of groundwater contamination from the YTA and reducing the levels of contamination in the affected water; however, Alternatives 6 and 7 were found to be most effective because of their incorporation of both groundwater treatment and source immobilization in the YTA. Remediation of the groundwater to acceptable health based levels would be achieved by Alternatives 3, 6 and 7 within 5 years of implementation of treatment; however, Alternative 3 would require a longer period of operation to handle the continuous leachate generation from the landfill.

8.1.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered Criteria (TBCs)

This criterion addresses whether or not an alternative will meet all ARARs of federal and state environmental statutes or provide a basis for invoking a waiver, as described under CERCLA Section 121 (d). Applicable requirements are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. To-BeConsidered criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding but that should be considered in determining the necessary level of cleanup for protection of health and the environment. TBCs do not have the status of ARARs; however, EPA's approach to determining if a remedial action is protective involves considering both ARARs and TBCs.

Each alternative was evaluated for compliance with ARARs, including chemical-specific, action-specific, and location-specific ARARs, in addition to TBCs. Every potential ARAR and TBC is presented in Table 8.2. The statutes are broken down in the table into federal and state regulations.

Alternatives 3, 6 and 7 were equally ranked since each alternative would attain their respective federal and state ARARs due to the implementation of institutional controls. These measures would ensure that there is no potential for future exposure to groundwater containing contaminant concentrations in excess of federal and state ARARs promulgated under the SDWA and Florida Drinking Water Standards, respectively. Alternative 1 would notcomply with any identified Site ARARs, and therefore, will not be considered in further evaluation.

8.2 Primary Balancing Criteria

8.2.1 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time, once cleanup levels have been met.

Alternatives 6 and 7 were found most effective since they include a capping component which would significantly reduce leachate generation and the rate of contaminant migration from the YTA. Alternative 3 would provide long-term effectiveness and permanence since the treatment process would substantially reduce the concentrations of contaminants in the groundwater; however, operation of the treatment system would have to be continued for approximately 15 years after MCLs are achieved to address the continued, uncontrolled release of leachate from the YTA.

8.2.2 Reduction of Toxicity, Mobility, or Volume

This is the anticipated performance of the treatment technologies an alternative may employ. The degree of reduction of toxicity, mobility or volume through treatment varies depending on the methods of groundwater extraction and treatment employed.

Alternatives 3, 6 and 7 would significantly reduce the toxicity and volume of site contamination, particularly that found in the groundwater. Since Alternatives 6 and 7 involve containment of the source material, they would reduce the mobility of the contaminants by decreasing the amount ofstormwater infiltration entering the YTA, thereby reducing the amount of leachate generated. This reduction in mobility is not due, however, to actual treatment of the source material. All factors considered, Alternatives 6 and 7 were found to be the most effective alternatives, with Alternative 3 ranking last.

8.2.3 Short-Term Effectiveness

This criterion refers to the period of time needed to completely achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup objectives are achieved. The following factors were used to evaluate the short-term effectiveness of each alternative: protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts from implementation of alternatives, and the time until remedial action objectives are met.

The construction activities for Alternatives 3, 6 and 7 would pose a minimal risk to the surrounding community; however, the groundwater treatment systems utilized in Alternatives 3, 6 and 7 would produce contaminated waste by-products that would require staging, transport and disposal, or treatment. Handling of these waste by-products may pose an additional risk to the community of off-site transportation and potential spillage.

Additionally, Alternatives 6 and 7 may create unquantified potential additional risks to remedial workers during clearing, grubbing and capping activities, through direct contact with waste materials, inhalation of fugitive dust, and contact with contaminated groundwater.

In each alternative, the protection of Site personnel would be afforded by the use of appropriate safety equipment to be worn at all times while working in contaminated areas. A properly implemented health and safety program would also provide for additional protection of personnel.

Adverse impact to the environment would be negligible for each alternative. Environmental impact, if any, would arise from dust particulate emissions at the Site and any accidental releases during off-site transportation of the waste by-products. A properly implemented health and safety program would address air monitoring requirements on-site and an off-site Emergency Contingency Plan would address any off-site release procedures.

8.2.4 Implementability

This is the technical and administrative feasibility of an alternative, including the availability of goods and services needed to implement the solution.

All of the alternatives are both technically and administratively feasible. From a technical perspective, alternatives, 3, 6 and 7, could be constructed, operated and maintained without much difficulty. Each of these alternatives would require acquisition of additional land adjoining the Site in order to implement the remedy; Alternative 3 would require approximately 4 to 6 acres, Alternative 6 would require approximately 43 acres, and Alternative 7 would require approximately 6 acres. Alternatives 3 and 7 were found most effective since the required additional land is minimal in comparison to that required by Alternative 6.

8.2.5 Cost

The following alternatives were assessed on a total cost basis using the estimated capital cost to perform the remedial work and the present worth cost for operation and maintenance costs, using a five percent discounted rate over a 30-year period. Table 8.4 details the capital and O & M costs for the 4 remedial alternatives. It is noted that for Alternatives 3, 6 and 7, cost estimates were based on the installation of a four-well extraction system and a two-well reinjection system, although additional wells may be required, as determined during Remedial Design.

Alternatives 3, 6 and 7 were ranked based on the total present worth costs. Alternative 3 ranked higher than Alternatives 6 and 7 since the groundwater treatment system under Alternative 3 would have to remain in full operation approximately fifteen years longer because this alternative does not include a capping component.

Alternative 6 (Cap entire site and Groundwater pump, treatment and discharge) is the most expensive remedial alternative at $20.1 million. The cost for Alternatives 3 and 7 are much less than the cost for Alternative 6 and offer a comparable degree of protection. Alternative 7 is substantially less expensive than Alternative 6, yet provides a comparable degree of protection because of the marginal benefit gained from capping the older previously closed waste cells.

8.3 Modifying Criteria

8.3.1 State Acceptance

This indicates whether, based on review of the RI Report, FS Report, and Proposed Plan, the U.S. EPA and the State agency agree on the preferred alternative.

The State of Florida, as represented by the Department of Environmental Regulation (FDER), has been the support agency during the Remedial Investigation and Feasibility Study process for the Madison County Landfill Site. In accordance with 40 C.F.R. S 300.430, FDER, as the support agency, has provided input during this process. Based upon comments received from FDER, it is expected that concurrence will be forthcoming; however, a formal letter of concurrence has not yet been received.

8.3.2 Community Acceptance

This indicates the public's support of a given alternative. Based on comments made by citizens and government officials at the public meeting held on September 1, 1992, and those received during the public comment period, the Agency perceives that the community believes that the overall selected remedy of capping the YTA and treating the groundwater would effectively protect human health and the environment. Each comment received during the public comment period has been addressed in Appendix A of this ROD, the Responsiveness Summary.

9.0 Selected Remedy

Based upon consideration of the requirements of CERCLA, the detailed analysis of the remedial alternatives and public comments, EPA has selected Alternative 7, Institutional Actions, Cap YTA Only, Extraction Wells, Air Stripping, Carbon Adsorption, and Reinjection, as the best course of action for source and groundwater remediation at the Madison County Landfill Site. Alternative 7 provides short and long-term protection of human health and the environment from potential threats associated with direct contact (ingestion) of the contaminated groundwater, and provides for immediate initiation of active restoration of the contaminated groundwater located beneath and in close proximity to the landfill property.

This alternative utilizes a groundwater extraction system with the extracted groundwater being treated by air stripping and granular activated carbon (GAC). The extraction system could be a single well or multi-well installation; the type used will be determined during remedial design. The remedial activities for Alternative 7, as modified by the incorporation of comments received from the governing state agency, include the following (See Figure 7.4):

- Installation of a clay/soil cap over the YTA;

- Contingent Installation of a passive gas collection andcontrol system;

- Construction of stormwater control facilities such as dikes, impoundments, and drainage ditches;

- Construction of a groundwater extraction well system;

- Installation of a groundwater treatment system including an air stripper and two GAC columns; and

- Installation of reinjection well(s) into the Floridan aquifer if a permit is obtainable. Should reinjection prove infeasible, other discharge options such as infiltration, irrigation and/or direct discharge will be evaluated.

Alternative 7 also includes, but is not limited to the following institutional measures which will be implemented by state and local government agencies:

- Access restrictions in the form of fences and signs around the landfill;

- Restrictions on future use of the Site to prevent construction of water supply wells and construction on-site that would require excavation;

- Land use ordinances or other measures restricting construction of water supply wells off-site in the downgradient flow path from the YTA; and

- Groundwater monitoring, which will include the installation of two additional monitoring well clusters.

Access restrictions will be required in order to prevent contact with the contaminated media. These restrictions may include fences and signs around the Site, as well as land use ordinances and deed restrictions. The current site owner, Madison County, will be required to conduct an inspection of the existing fence surrounding the landfill and perform any work necessary to make the existing fence complete and provide on going maintenance of the fence, as required by Section 403.7255, Florida Statutes and Rule 17-736, F.A.C.. Also, this rule requires PRPs to supply, install and maintain warning signs around the Site.

Both deed restrictions and land use ordinances may be used by state and local government agencies to notify land owners that groundwater contamination exists beneath the property and prohibit the construction of new water supply wells in the affected area. A deed restriction, which is a negotiated addendum to an existing deed that indicates that the groundwater resource below and in close proximity to the property is not considered safe for potable or other uses, notifies the existing property owner and any subsequent owners of the groundwater condition during the time the aquifer is not usable. Additionally, restrictions on future use of the Site and the area immediately downgradient of the YTA will prevent construction of new water supply wells and prohibit construction on the site property that requires excavation while the remedial action is undertaken.

Restricting the use of groundwater in the potentially affected area will be accomplished by dividing the area into two control zones as shown in Figure 7.4:

- Control zone 1 is a 3,000-feet wide corridor with a depth that begins at monitoring well IT1 and extends to monitoring well IT3. The construction of new water supply wells within control zone 1 would be prohibited. No water supply wells currently exist in control zone 1.

. Control zone 2 is a 3,000-feet wide corridor situated between monitoring well IT3 and extends to a depth of 3,000 feet downgradient of monitoring well IT1. Initially, no restrictions would be imposed for groundwater within control zone 2. However, in the event that subsequent monitoring indicates the presence of contaminant levels above MCLs in downgradient point of compliance wells, the restrictions applied to control zone 1 would also be imposed on control zone 2. Also, EPA will consult with the SRWMD prior to their allowance of any potable well installations in control zone 2 during time of aquifer remediation.

Should additional domestic water supply wells in either zone show contamination during the monitoring period, the owners would be notified and would be provided with the opportunity to hook-up to City water in order to prevent further exposure to the contaminated groundwater. The restrictions on use of the aquifer would not be required after EPA certifies achievement of the performance standards specified in Section 8.1.2.

Two additional groundwater monitoring well clusters will be installed as part of this remedial action. These well clusters will be located along the eastern landfill property boundary to monitor other potential source areas located outside of the capped YTA area. Groundwater monitoring will be conducted to periodically assess the degree and extent of groundwater contamination. Monitoring wells M-2, M-5, IT-13 and monitoring well clusters IT-1, IT-2, IT-3, IT-4, IT-6, IT-7 will be monitored quarterly for the chemicals of concern for a period of 25 years or until it is determined that monitoring is no longer needed. Additionally, monitoring well M-1, the two newly installed monitoring wells, and the four newly installed replacement domestic wells, located in close proximity to the existing contaminated domestic wells, will be monitored on the same schedule under this remedial action. Based on the sampling results generated, EPA may at some point determine that a less frequent monitoring schedule is appropriate.

A review of the Madison County Landfill site history indicates that the chemicals of concern were transported about 1,500 to 2,000 feet in the 14 year period between 1971 and 1985. Data results show that the annual average values of TCE and DCE are currently approaching MCL concentrations and that vinyl chloride concentrations have stabilized. Assuming that this observed trend in attenuation continues, a 25 year period of monitoring downgradient wells should be adequate to monitor and document the attainment of MCL concentrations in groundwater.

The process options forming Alternative 7 allow the source of contamination to be contained while lowering the levels of contaminants in the contaminated groundwater. The capping component will reduce the volume of leachate generated, thus reducing the further contamination of the aquifer.

This alternative requires the acquisition of approximately 6 acres of land in the vicinity of the YTA in order to construct the stormwater management system and other components of the remedial action.

To facilitate capping of the southeast corner of the landfill, the YTA and areas where the stormwater management facilities are to be constructed will be cleared and grubbed. Clearing the Site involves removing all surface materials including shrubs, trees, and debris. Approximately 11 acres has to be cleared and grubbed.

The YTA cap material will be selected in accordance with Rule 17701, F.A.C. and will consist of multiple layers of compacted clay soil and top soil. The cap material will be designed in accordance with Rule 17-701, F.A.C. The capped area will be graded so that surface water run-off is directed to the stormwater collection system.

Since Alternative 7 only provides for capping of the YTA, where vegetative yard trash and construction debris were placed, no significant generation of methane gas is anticipated in conjunction with capping of the YTA; therefore, no passive gas collection/control system should be necessary. In the event that monitoring indicates methane gas generation has occurred, a passive gas collection and control system will be designed and installed at the Site in accordance with Rule 17-701, F.A.C.

A stormwater management system will be designed and installed according to state and federal regulations to manage stormwater run-off in the vicinity of the YTA, to protect the treatment system and reinjection well(s) from surface water inflow and to prevent run-off of contaminated stormwater from the remedial project construction activity. The installation of this stormwater management system requires the acquisition of approximately 6 acres of property immediately south and east of the YTA.

Groundwater will be extracted at approximately 250 gpm using submersible centrifugal pumps from an extraction well system installed on the southeast corner of the YTA. The extracted groundwater will be pumped through a treatment system (air stripper and GAC unit) and discharged into one or more reinjection wells located downgradient of the extraction well system. If a reinjection well permit is not attainable other process options such as infiltration, irrigation and/or direct discharge will be introduced and further developed as discharge options.

Referring to Table 8.2, the site-related contaminants of concern have Maximum Contaminant Levels (MCL) as promulgated under the Safe Drinking Water Act (40 C.F.R. 141, 143) and Florida's Drinking Water Standards. The MCLs for the groundwater chemicals of concern are listed in Table 5.1 and will be used as the performance standards for each contaminant at and beyond the points of compliance. Pumping and treating will continue until the remediation levels for these chemicals are achieved. Prior to reinjection, the treated groundwater must meet the State and Federal drinking water standards.

Technically, all of the processes making up this alternative can be constructed, operated and maintained without any unusual difficulty; however, administrative difficulties could be anticipated. First, this alternative requires that approximately 6 acres of land be acquired in order to construct the stormwater management system and other components of the remedial alternative. Acquiring the needed property and enacting the required ordinances prohibiting construction and use of water supply wells could present some difficulty. Second, the substantive requirements of a consumptive use permit from the SRWMD to construct the extraction system must be met. Meeting the requirements of a consumptive use permit is feasible. However, discharge of the treated groundwater could require compliance with other requirements as described under Alternative 3, Section 2.7, Summary of Remedial Alternative Evaluation.

The air stripper will be designed and constructed in accordance with Rule 17-2, Florida's Air Quality Standards. A pre-construction review by FDER of the proposed air stripper will be necessary under the provisions of Chapter 403, Florida Statutes, and Chapter 17-2, F.A.C. An air permit is not necessary as this will be an on-site action under CERCLA; however, the substantive requirements of such a permit must be met.

Because the reinjection zone is located off-site, construction and use of reinjection wells will require a permit or variances from FDER, pursuant Chapter 17-28, F.A.C. which governs underground injection. The time required for construction (not implementation) of this alternative is conservatively estimated to be approximately 2 years, from completion of the remedial design.

This alternative has the potential to achieve the Remedial Action Objectives (RAOs), including the achievement of federal and state MCLs, and be protective of the environment and human health. The extraction system has the capability to remediate the contaminated groundwater for an approximate 175,000 square foot area around the southeast corner of the YTA. Should subsequent monitoring identify other sources of groundwater contamination, the remedial action will be modified as necessary to address the additional areas of contamination.

The estimated time for this system to meet RAOs at the point of compliance (500 feet downgradient of monitoring well IT-1) is estimated to range between 3 to 5 years. The estimated time includes the time required for construction of the alternative (0.5 to 2.5 years), the time for remediation of the aquifer (approximately 1.5 years based on modeling results) and the time required for four quarterly monitoring events (1 year).

For purposes of comparability and practicality, capital and present worth costs were based on the installation of a single-well extraction system and a two-well reinjection system. The actual number and placement of the wells within each system will be determined during remedial design. If EPA determines that more wells are necessary, the cost will increase accordingly. Also, the additional installation of two monitoring well clusters and the expanded groundwater monitoring program were not accounted for in the cost analysis presented in the FS Report. The total present worth cost of Alternative 7 will increase proportionally with the additional components added to the selected remedy. Table 9.1 details the cost analysis summary for Alternative 7 as presented in the Feasibility Study. The estimated capital costs to be expended over a one to two year period of construction are estimated to be $3,445,750. O&M costs to be expended over a period of 25 years range between $109,600 and 409,600, annually. The estimated total present worth cost is $5,191,000. As noted, these costs will be adjusted accordingly during remedial action.

During the first 3 - 5 years, the pump and treatment system will beconstructed and operated. After the performance standards have been met, the treatment system will be shut down thereby lowering O&M costs for the remaining years. The O&M costs remaining would be that associated with groundwater monitoring.

Long-term groundwater operation and maintenance activities will include quarterly monitoring for a minimum of five years. At that time EPA will evaluate the feasibility of using a less frequent monitoring schedule for the duration of the 25-year long-term groundwater monitoring program. Long-term operation and maintenance requirements such as routine maintenance checks are expected for the recommended alternative, including the integrity of the installed cap. Monitoring will determine the effectiveness of the clay/soil cap and the implemented pump and treatment system at reducing migration of contaminants in the groundwater and remediating groundwater to meet the performance standards. An Operation and Maintenance Plan will be developed during the Remedial Design/Remedial Action tasks.

Design Considerations

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this Site, as a drinking water source. Based on information obtained during the RI and on a careful analysis of all remedial alternatives, EPA believes that

the selected alternative will achieve this goal. It may become apparent, during implementation or operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated plume. In such a case, the system performance standards and/or the remedy may be reevaluated by EPA.

The selected remedy will include groundwater extraction for an estimated period of 5 years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. To insure that the design of the system is optimized, modifications may be considered prior to invoking contingency measures. These modifications may include but are not limited to the following:

a) at individual wells where cleanup goals have been attained, pumping may be discontinued;

b) alternative pumping at wells to eliminate stagnation points;

c) pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater;

d) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume and/or mitigate additional source areas; and

e) implement other measures to address additional source areas as deemed necessary.

To ensure that cleanup goals continue to be maintained, the aquifer will be monitored at those wells where pumping has ceased on a quarterly basis until

EPA determines that a less frequent monitoring schedule is acceptable, for a period of 25 years.

10.0 Statutory Determinations

Under its legal authority, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws unless a statutory waiver is justified. Theselected remedy must also be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the toxicity, mobility or volume of hazardous wastes as their principle element. The following sections discuss how the selected remedy for this Site meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy satisfies the requirement of CERCLA Section 121 to protect human health and the environment by eliminating risks posed through each exposure pathway and to each population through treatment. It ensures adequate protection of human health and the environment. The site risk will be reduced to well below the 1E-6 risk range for carcinogens.

The selected remedy of implementing institutional actions, capping the YTA, and treating (air stripping/carbon adsorption)/reinjecting the groundwater protects human health and the environment through the imposition of institutional controls, groundwater restoration, and future site monitoring. Restricted access to both the Site and the groundwater below eliminates the threat of direct contact (ingestion) of the VOC-contaminated groundwater to current and future landowners in the vicinity of the Site. Additionally, implementation of the groundwater treatment system will eliminate the potential ingestion threats to downgradient receptors, and will restore the groundwater to levels deemed acceptable by EPA and the State.

Implementation of Alternative 7 will not pose any unacceptable short-term risks or cross-media impacts to the Site, the workers, or the community that cannot be readily controlled. Potential risks associated with transportation of waste by-products and discharge of treated groundwater off -site will beminimized by following the respective Health & Safety and Discharge Permit Plans.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered Criteria (TBCs)

Section 121 (d)(2)(A) of CERCLA incorporates into the law the CERCLA Compliance Policy, which specifies that Superfund remedial actions must meet any federal and state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Also included is the provision that state ARARs must be met if they are more stringent than federal requirements.

Applicable requirements are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. To-Be-Considered criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding but that should be considered in determining the necessary level of cleanup for protection of health and the environment. TBCs do not have the status of ARARs; however, EPA's approach to determining if a remedial action is protective involves considering both ARARs and TBCs.

All potential ARARs and TBCs for treating contaminated groundwater at the Madison County Landfill are presented in Table 8.2. Where VOCs and inorganic constituents affect groundwater, the Safe Drinking Water Act (SDWA) provides potential ARARs for establishing cleanup goals, i.e., Maximum Contaminant Levels (MCLs). In addition, the State of Florida has established guidance concentrations for specific Volatile Organic Compounds, which, when more stringent than the federal MCL, have been selected as the cleanup goals for this project.

The recommended alternative was found to meet or exceed the following ARARs and TBCs selected from Table 8.2 which directly apply to the selected remedy, as discussed below.

Chemical-Specific ARARs:

- Safe Drinking Water Act, SDWA (40 C.F.R. SS 141, 142 and 143), which specifies the MCLs for the contaminants of concern that will be applicable as the remediation levels for contaminated groundwater. However, should the state drinking water standard under 17-550, F.A.C. for a particular contaminant be more stringent, the state standard will be used as the remediation level.

- SDWA (40 C.F.R. SS 144.12, 144.13 and 147), which applies to the injection of treated effluent into the Floridan aquifer. A permit will be required since reinjection will take place offsite.

- Resource Conservation and Recovery Act, RCRA (40 C.F.R. S 261.31), which applies to chemical concentrations in groundwater.

- Florida (FLA) Drinking Water Standards (17-550, F.A.C.), which establishes contaminant concentrations acceptable in potable water. These standards will be applicable when more stringent than the federal MCL.

- FLA Underground Injection Control and Groundwater Discharge (17-28.700, F.A.C.), which applies to the treated effluent being reinjected into the Floridan aquifer. These standards will be applicable when more stringent than the federal standards.

Location-Specific ARARs:

- Endangered Species Act (50 C.F.R. S 402), which requires that federal agencies ensure that their actions do not jeopardize the continued existence of a threatened or endangered species.

Action-Specific ARARs:

- RCRA (40 C.F.R. S 264 Subtitle C for Landfill Closure), which applies to the closure of the YTA and maintenance of the cap should any portion of the comparable state regulation be waived.

- SDWA (40 C.F.R. SS 144.12, 144.13 and 147), which applies to the reinjection of treated effluent into the Floridan aquifer. A permit will be required since reinjection will take place offsite.

- Clean Air Act, CAA (40 C.F.R. S 61, CAA S 112), which applies to air emissions from treatment technologies, such as air stripping. Also, 40 C.F.R. SS 51.160 through 51.164 describe the preconstruction and permitting process for air emissions. Since treatment will occur on-site, only the substantive requirements of PSD permit must be met.

- Hazardous Materials Regulations (49 C.F.R. SS 170 to 179), which applies to transportation of hazardous materials or waste byproducts, such as the spent carbon generated during groundwater treatment.

- FLA Solid Waste Management Facilities (17-701, F.A.C.), which applies to closure of the YTA and maintenance of the cap. These standards are applicable since they are more stringent than the federal regulations under RCRA 40 C.F.R. S 264.

- FLA Drinking Water Standards (FDER 17-550), which establishes MCLs for groundwater and effluent from treatment systems. These standards will be applicable when more stringent than the federal regulations under the SDWA.

- FLA Ambient Air Quality Standards (17-2, F.A.C.), which applies to air emissions from treatment technologies, such as air stripping. These standards will be applicable when more stringent than the federal regulations under the CAA.

- FLA Underground Injection Control and Groundwater Discharge (17-28.700, F.A.C.), which is applicable to treated effluent discharged into groundwater through a reinjection well. Permit required. These standards will be applicable when more stringent than the federal standards for reinjection.

- FLA Solid and Hazardous Waste Management Act (403.702, F.S., et. seq.), which applies to the transportation and disposal of hazardous waste. These standards will be applicable when more stringent than the federal regulations under 49 C.F.R. SS 170 to 179.

- FLA Hazardous Waste Rules (17-730, F.A.C.), which applies to the treatment, storage and disposal of hazardous waste. These standards will be applicable when more stringent than the federal standards.

- FLA Water Quality Standards (17-520, F.A.C.), which establishes groundwater quality standards that will be applicable to the treated effluent when more stringent than the federal regulation.

- FLA Stormwater Discharge Regulations (17-25, F.A.C.), which applies to the containment, storage and discharge of stormwater. These standards will be applicable when more stringent than the federal regulation.

- FLA Warning Sign Rule (17-736, F.A.C.), which applies to the installation and maintenance of warning signs around a NPL site.

Other Criteria To-Be Considered:

The RCRA Land Disposal Restrictions (LDRs) (40 C.F.R. S 268 D), arenot applicable or relevant and appropriate requirements for this project because the waste streams (the solid, domestic trash and the hazardous chemicals) were not mixed during disposal. The hazardous constituents were placed in drums then buried in the YTA. Also, based on the RCRA definition of "placement," LDRS will not be triggered by any excavation, clearing, and/or grubbing activities that will take place during remedial action at the Site. The borrow material that will be used during the capping activities has not been mixed with the hazardous source material, and therefore, will not trigger LDRs during placement.

Also, EPA has developed a policy for control of emissions from air stripper operations at CERCLA sites, entitled Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, June 15, 1989 (OSWER Directive 9355.0-28) which should be used as guidance for control of emissions generated during remedial action.

10.3 Cost Effectiveness

This alternative affords a higher degree of overall effectiveness in not only protecting the public against direct exposure but in removing the threat of a future release of contaminants. The estimated total present worth cost of this alternative is $5.1 million (including operation and maintenance).

The selected remedy affords overall effectiveness proportional to its cost, such that the remedy represents a reasonable value for the money. When the relationship between cost and overall effectiveness of the selected remedy is viewed in light of the relationship between cost and overall effectiveness afforded by the other alternatives, the selected remedy appears to be cost-effective.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

U.S. EPA has determined that this remedy is the most appropriate cleanup solution for remediating the source and groundwater contamination at the

Madison County Landfill Site and that it provides the best balance among the evaluation criteria for remedial alternatives evaluated. This remedy provides effective protection in both the short and long-term to potential human and environmental receptors, is readily implemented, and is cost effective.

The selected remedy satisfies the requirement of section 121 to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

10.5 Preference for Treatment as a Principal Element

This remedy meets the statutory requirements to utilize permanent treatment technologies to the maximum extent practicable. The selected remedy satisfies the preference of CERCLA section 121 for treatment as a principal element.

Because wastes will remain in the YTA beneath the cap above healthbased levels, EPA will review the Site at least every five years to ensure the effectiveness of the treatment process and the integrity of the cap.

11.0 Documentation of Significant Changes

The Proposed Plan for the Madison County Landfill Site was released to the public on August 24, 1992. The Proposed Plan identified Alternative 7, Institutional Actions, Cap YTA Only, Extraction, Treatment (Air Stripping/Carbon Adsorption (GAC)), and Reinjection, as the preferred alternative for site remediation. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.